Planning for sustainable spatial development: principles and application.

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PLANNING FOR SUSTAINABLE SPATIAL DEVELOPMENT: PRINCIPLES AND APPLICATION

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Abstract

Space -- and in particular land use _ forms the geographical projection of the dispersion of human activities In the light of the environmental externalities of these activities, space demonstrates also the spatial dispersion of environmental decay. It is clear that space is thus also the geographical platform of conflicting issues in land use management and physical planning. in particular in an urbanized world.

In the past decades a wide variety of decision support methods and expert systems has been developed to cope with the need for sustainable spatial development. The paper will give an overview of recent issues in this area with a particular view to urban sustainability. It will also offer a survey of recently developed decision support methods for sustainable land use management. in particular multicriteria methods.

The approach will be illustrated by an empirical application to sustainable city planning of the Italian city of Cremona, seen from the perspective of sustainable development The paper will be concluded with some retrospective and prospective research remarks.

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1. New Scarcity: Quantity and Quality

"Degradation and destruction of environmental systems and natural resources are now assuming massive proportions in some developing countries, threatening continued, sustainable development. It is now generally recognized that economic development itself can be an important contributing factor to growing environmental problems in the absence of appropriate safeguards. A greatly improved understanding of the natural resource base and environment systems that support national economies is needed if patterns of development that are sustainable can be determined and recommended to governments" (World Bank 1992).

Environmental issues are not just a phenomenon from modern times. Also in ancient periods we have records on environmental decay, in both urban environments and landscapes. What makes environmental problems more pronounced in the second part of the twentieth century, is the large scale occurrence of environmental decay. There is no country or area anymore, which is not directly or indirectly suffering from environmental externalities. This quantitative extension of environmental problems has several backgrounds: a rising number of people. a more internationally interlinked network economy with trade and transport (the 'ecological footprint'), and so forth. But there are also qualitative and structural factors that are responsible for the new scarcity: the use of synthetic and non-biodegradable materials, the shift from local to global environmental decay or the transition towards more mobile lifestyles. Against this background the notion of sustainable development has become 'en vogue'. as it mirrors the broad context within which the environmental problem has to be positioned. Space and time play a critical role in this concept. since through these two dimensions it is possible that environmental externalities are dispersed. either to other areas or to future generations.

Land use is thus an intrinsic component in the environmental debate. It reflects the functional distribution of man-made and natural development in terms of both visual and ecological welfare aspects. It is only until very recently that the productive nature of the natural environment is again recognized as a major element in production systems (following earlier contributions offered by the physiocrats in the eighteenth century). Not only has the distinction between renewable and non-renewable resources become more evident, but also related functions of natural resources, such as cultural, artistic, scientific or touristic functions.

In the debate among economists regarding measures for coping with environmental externalities, the standard therapy for solving market failures, i.e., Pigouvian taxes has become rather popular in recent years (witness e.g., the discussion on eco-taxes). Others still advocate alternative policy approaches such as tradeable permits, standard setting or even prohibitions In practice, we have seen a portfolio of different policy measures reflecting a compromise between different political-economic viewpoints.

In all discussions on sustainable development, we observe the need for a broad evaluation of environmental issues, in which economic, social and environmental characteristics or attributes play an intrinsic role (see also Figure 1).

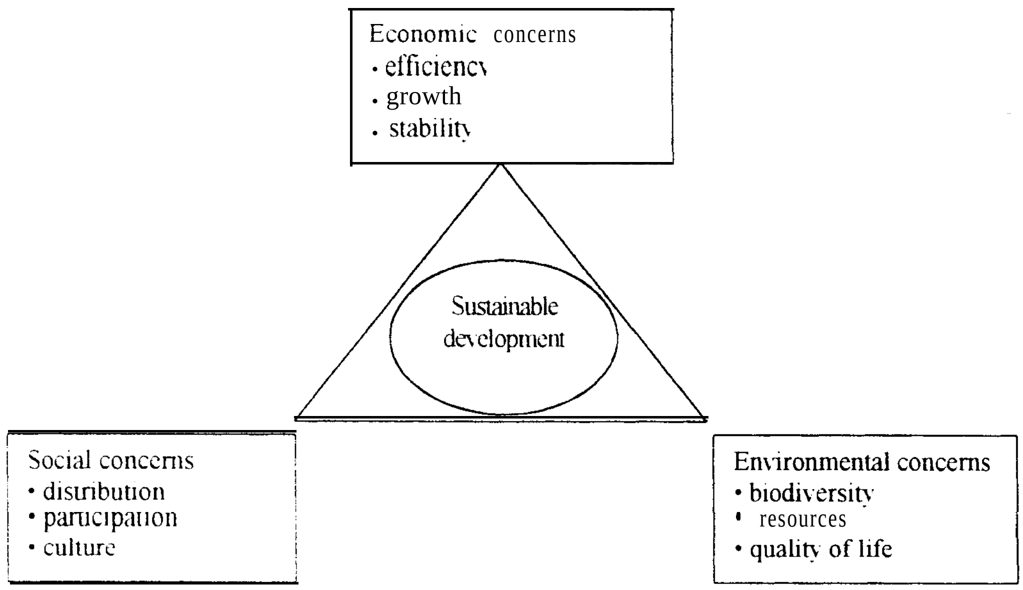

Figure 1. The triangular concern on sustainable development

It can easily be seen that sustainable development is not a given endpoint-state of an economic-social--ecological system. It is based on complex trade-offs, related to priorities attached to intergenerational equity. weak and strong sustainability, absolute and relative delinking, local versus global sustainable development (including ecological footprints), and so forth (see also Van den Bergh and Hofkes 1998 and Van Pelt 1993). In recent years there has been an intense debate on the so-called delinking hypothesis, which means that in a balanced growth situation it is possible to realize a rise in income per capita accompanied by a rise in environmental quality. The debate is particularly induced by the so-called factor 4 and factor 10 discussion instigated by the Wuppertal Institute. In the macro-economic literature we see this issue reflected in the Environmental Kuznets Curve (EKC) debate, in which it is assumed that an inverse U-shaped curve for the relationship between environmental degradation and income per capita may exist, if a growing income stimulates environmental awareness and hence effective environmental policies

The multidimensional judgement of sustainability conditions (see also Figure 1) is necessarily based on political choices as there is – in the presence of externalities and other market failures – no way to create unambiguous trade-offs among diverse welfare constituents. For example, in the area of land use and landscape protection, one might make a distinction between environmental functions which may be evaluated on the basis of their use value and environmental functions related to option values (such as bequest values or conservation values). Only part of these functions can be translated into the measuring rod of money. This has enormous implications for environmental planning, as we will set out in the next section.

2. Sustainability as a Planning Task

There has been an ongoing debate in the past decade on the scientific merits of the concept of sustainable development. But at the same time there has been a policy debate on the question what kind of measures and policy strategies would be necessary to ensure sustainable development. In reality, this has become a complicated mission, as the sustainability concept is a multi-faceted and complex notion which is characterized by conflicting elements. This is clearly reflected in land use planning where economic. social and ecological interests mirror a diverse portfolio of policy objectives. We may also refer here to the FAO (1993) description of land use planning: "*Land use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adapt the best land use options.*" Clearly, the most difficult question here is: what is best, i.e., from which perspective?

In the literature on planning theory we may distinguish several concepts of rational planning aiming at achieving the best possible outcome of decisions in the public sector:

- **optimization:** this is a standard rationality paradigm which assumes an unambiguous objective function with clearly specified constraints and Ml information;
- **satisficing behaviour:** this presupposes high transaction costs in achieving an optimal outcome (e.g., as a result of conflicting interests or incomplete information), so that a second-best solution may be found;
- **multidimensional decision-making:** this idea takes for granted different actors or a set of different objectives leading to multidimensional trade-off issues among different choice possibilities (reflected e.g. in multiple criteria analysis), thus creating best compromise solutions;
- **accountability:** in this view on planning the main task is to ensure a decision or policy outcome that can be justified in the light of prevailing regulations, procedures or established practice, without resorting explicitly to any optimality criterion.

In our approach we will opt for a multidimensional decision-making approach, as this is most flexible and in agreement with many practices that are governed by conflicting views or priorities This approach can also be used for various levels of decision-making, such as strategic. tactic or executive

In recent years we have witnessed an important addition to the scope of physical planning, viz the sustainability motive In the Agenda 21 agreed upon at the Rio Summit it was stated that land use planning should strive for *'promoting sustainable human settlement development'* In Figure 2 a presentation of the scope of sustainable land use planning is given

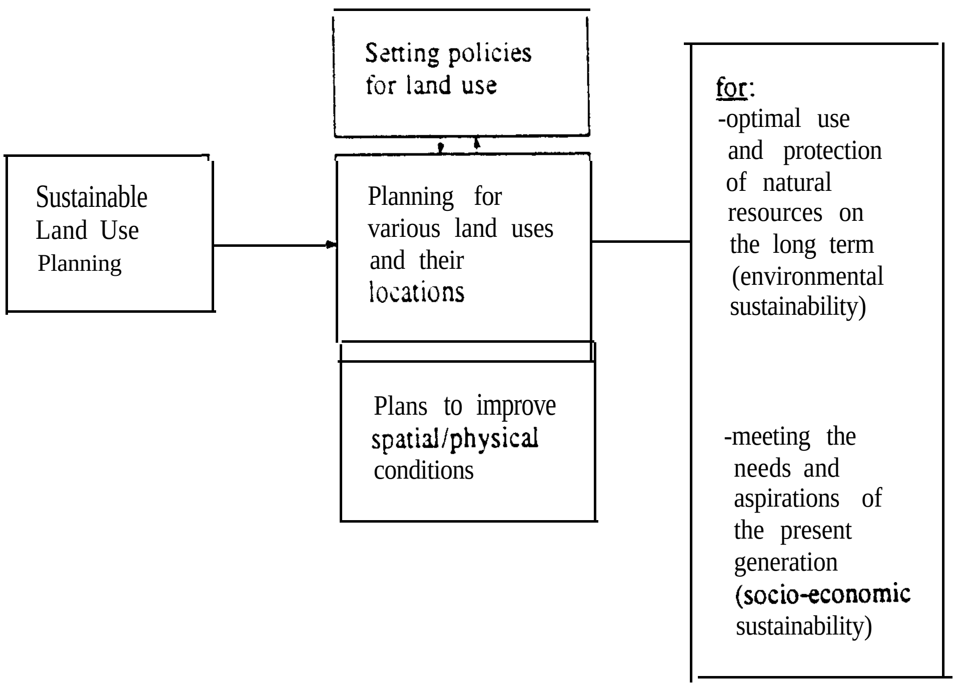

Figure 2. Sustainable planning of land use
Source: Van Lier et al. (1994)

This general scheme can be further subdivided by considering the various interests and actors involved (see Figure 3).

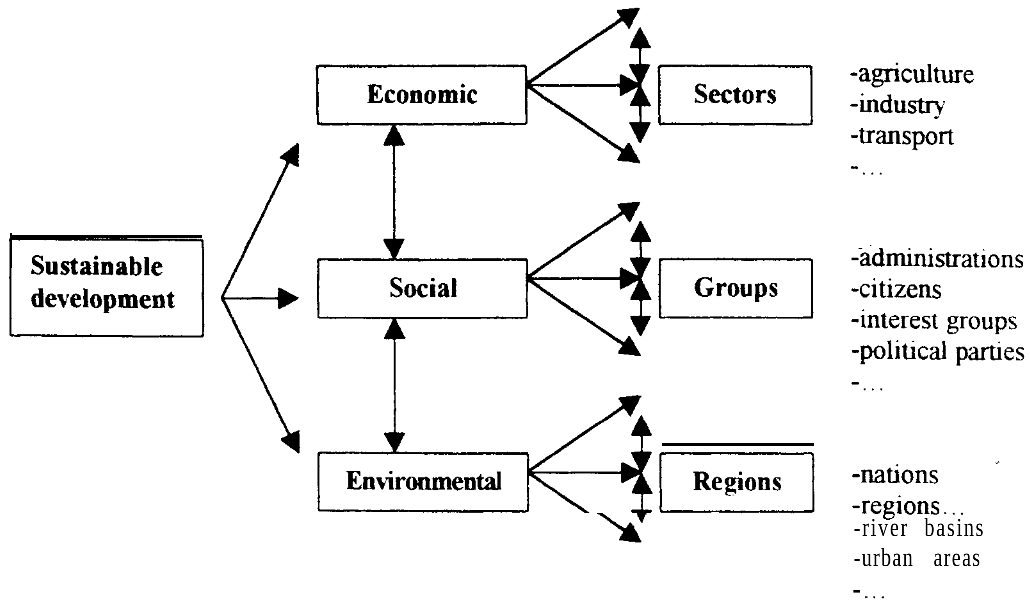

Figure 3. Representation of strategic sustainable planning
Source: Beinat and Nijkamp (1998)

It is clear that the general concern on environmental decay causes much interest in negative environmental externalities, but it ought to be recognized that also various positive externalities may exist. For example, in a study on urban externalities Stanghellini and Stellin (1996) distinguished various types of externalities (see Table 1) In the same vein. also Camagni et al. (1998) developed a classification of both positive and negative externalities in the light of the need for developing sustainable cities (see Table 2). In the next section we will address more explicitly the notion or urban sustainability.

EFFECTS			EXTERNALITIES	
			POSITIVE	**NEGATIVE**
	1. Source	Production	Integration of production sector	Emissions/pollution
		Consumption	Accessibility to environmental. cultural. architectural resources	Pollution Congestion
Technological	2. Type of use	Private	System of waste (resources) recycled	Traffic pollution Waste
		Public	Environmental urban public goods (e.g. green areas)	Derelict areas
Monetary			Increasing value of suburban rural land	Increasing cost of basic resource scarcih

Table 1. Externalities in the urban area
Source: Stanghellini and Stellin (1996)

	Interaction between economic and physical environments	Interaction between economic and social environments	Interaction between social and physical environments
Positive external effects	Efficient energy use Efficient use of non-renewable natural resources Economies of scale in the use of urban environmental amenities	Accessibility to qualified housing facilities Accessibility to qualified jobs Accessibility to social amenities Accessibility to social contacts Accessibility to education facilities Accessibility to health services Diversification of options	Green areas for social amenities Residential facilities in green areas Accessibility to urban environmental amenities
Negative external effects	Depletion of natural resources Intensive energy use Water pollution Air pollution Depletion of green areas Traffic congestion Noise	Forced suburbanisation due to high urban rents Social frictions on the labour market New poverties	Urban health problems Depletion of historical buildings Loss in cultural heritage

Table 2. Positive and Negative External Effects of the Interaction between the Different Environments in a City

Source: Camagni et al. (1998)

3. Planning for Urban Sustainability

Our world is becoming increasingly urbanized – with all the advantages and disadvantages that go with it. The geography of the twentieth century exhibits an intensified trend towards an urban way of life in modern society. Despite suburbanization – and sometimes de-urbamzation tendencies – the city remains the nucleus of a developed economy. It is undoubtedly true that the economies of density and scale are decisive factors for city formation. Clearly. there are also dis-economies as witnessed by congestion, environmental decay and so forth. Nevertheless, the positive features of the city still appear to be a dominant force, as the city is an extremely efficiently organized geographical entity.

In recent years we have witnessed an increasing interest in the concept of the sustainable city (see, e.g., Haughton and Hunter 1994; Nijkamp and Perrels 1994; Selman 1996; Capello et al. 1999). As our world is moving towards an urban world (with an urbanization rate exceeding approx. 70 per cent), it makes certainly sense to consider cities as nuclei of a sustainability policy. From a management perspective, cities are also anchor points for administrative and policy action. while they may also be in a better position to induce citizen's participation and public support And finally. from a research perspective, cities are clearly demarcated statistical units which may be able to offer the necessary data for policy analysis

Clearly, the urban environment is a multi-faceted phenomenon ranging from 'hard' pollution indicators to 'soft' quality-of-life indicators. The urban environment is. however, the playing ground of many conflicting interests, both sectorally and geographically, so that the concept of the sustainable city is an interesting test case for the notion of 'civitas'.

From a spatial perspective, urban sustainability has also played an important role in recent discussions on urban spatial configurations, such as the compact city, the green city, the garden city, the ecological city, the edge city and the virtual city. Thus far, no unambiguous concept has emerged and in reality we observe a parallel development of various contemporaneous urban concepts.

An important issue is whether the spatial scale of the city should be limited to the urban boundary or whether also the broader geographical dimensions would have to be taken into consideration. This question of the so-called ecological footprint has been extensively discussed in the literature (see Wackemagel and Rees 1996). It leads essentially to a distinction between internal and external urban sustainability (see Nijkamp and Opschoor 1997). In this context, strong urban sustainability would emerge in case of both internal and external urban sustainability. Consequently, urban sustainability has also important geopolitical dimensions, which are partly related to land use and partly to other functions of the city (including its surroundings). This is also clearly reflected in the great many initiatives following the adoption of Agenda 21, which require a great variety of policy initiatives and strategies.

Clearly, an environmentally sustainable development of a city can only be attained by initiating appropriate policy strategies. On this subject much literature can be found which focuses on the design of concepts or frameworks needed for such policies. It is clearly that initiatives in various cities world-wide differ strongly in the adoption and implementation of such concepts, because each city has its own specific geographical, political and environmental setting. Nevertheless, general integrative concepts and evaluation procedures may be developed which can serve as guidelines for many cities undertaking sustainability initiatives. A broad survey of such concepts can be found in Selman (1996), while an overview of policy strategies can be found in OECD (1995). Although it is likely that environmental quality problems may become more severe with urban size, there is no clear evidence that urban size as such causes environmental decay. According to Orishimo (1982) it is not the sheer city size, but rather the implied land use, the transport systems and the spatial lavout of a citv which are critical factors for urban environmental quality.

Policies addressing sustainable development of cities should, therefore, cover multiple fields like urban rehabilitation, urban land use, urban transport systems, urban energy management. urban architecture and conservation policy, and urban cultural policy. Measurable indicators including minimum performance levels and critical threshold levels will then have to be defined, estimated and used as forecasting tools so as to improve awareness of sustainable development issues of modern cities. Local authorities will have to share their tasks with all other actors in the urban space (including the private sector) in enforcing and maintaining these critical thresholds. It goes without saying that urban sustainable development is a process rife with conflicts and incompatibilities. Commitment to a strict environmentally sustainable urban development by key actors in a city is necessary for a successful implementation of sustainability policies. In doing so also economic (market-based) incentives are desirable in order to increase efficiency and to cope with the negative factors of modem city life. Failure to develop an effective balanced urban development policy will reinforce urban sprawl and will highlight inner city problems to a much larger area. Environmental-benign urban policies may, on the other hand, attract new investments, favour urban employment, and hence contribute to an increase in quality of life. The successfulness of such interventions depends clearly on thre major background determinants:

- *institutional factors* (management and organization of the urban energy sector, public-private modes of cooperation etc.);
- *attitudes and behaviour of citizens* (life styles, mobility patterns, environmental awareness etc.);
- *urban structure and morphology* (population density, urban form, transportation networks etc.).

Local authorities have the possibility to exert both a direct and indirect influence on these determinants. The question whether a given urban development is sustainable or not is co-determined by the targets set by policy-makers. There is not a single unambiguous urban sustainability measure, but a multitude of quantifiable criteria which may be used in an empirical test. A necessary condition for implementing an effective planning system for urban environmental management geared towards maintaining sustainability is the development of a system of suitable urban environmental indicators (see OECD 1978). Such indicators, which should represent a balance between the necessary quality of information and the costs involved, would have to be related to economic, social, spatial and cultural dimensions of the city. The OECD has drawn up a long list of elements which are decisive for urban environmental quality and which would have to be included in such an indicator system. Examples are: housing, services and employment, ambient environment and nuisances, social and cultural concerns. etc. However, it appears to be extremely difficult to operationalize such an indicator system. This means that precise empirical evidence on urban environmental quality and on the implications for both household and firm behaviour is not always available. In light of the previous observations, the conclusion seems warranted that the road towards sustainable cities is not an easy one.

4. Evidence on Urban Sustainability

It goes without saying that any policy focused on the achievement of sustainable development in space and time requires an enormous political effort. The Rio Summit of the United Nations on Environment and Development (1992) has expressed this in clear terms as *follows: "In order to meet the challenges of environment and development, states decided to establish a new global partnership. This partnership commits all states to engage in a continuous and constructive dialogue, inspired by the need to achieve a more efficient and equitable world economy, keeping in view the increasing interdependence of the community of nations, and that sustainable development should become a priority item on the agenda of the international community."* To attain these high ambitions. it is necessarv to establish from an international perspective - local sustainability actions and initiatives Agenda 21 presents many such ideas and commitments based on a balance between local economic, social and sociological interests of cities A further translation in the European setting can be found in the European Charter from Aalborg (1994) in which partnership programmes are foreseen.

An example of an inventory of success and failure determining factors in partnerships for sustainability and Local Agenda 2 1 initiatives can be found in Table 3.

Positive features in environmental partnerships:

- need for a specific focus
- multi-partite comprehension of the nature of the problem
- solutions which are appropriate to the context
- approaches which are innovative and flexible (i.e. a willingness to adapt and to avoid mindset)
- inclusion of diplomacy and conflict resolution skills
- inclusion of 'animateur'
- proposals to build capacity (individual and organisational)
- deliberate diversity
- adequate financial resources
- commitment to communicanon
- ownership of the partnership by all pames
- wide participation
- trust, transparency and accountability
- north-south dimension
- leadership and clarity
- evidence of added value and specific projects
- experts 'on tap' rather than 'on top'

Negative features in environmental partnerships:

- hidden agendas
- Inequality, competitiveness and intolerance
- sectoralism
- excessive dependence on external aid/expertise
- inadequate administrative support
- problem avoidance (acceptance of a 'false consensus')
- mutual distrust
- different 'languages' of different sectors
- poorly developed methodology
- sharp changes to existing structures
- excessive complexity
- over-reliance on experimental approaches

Table 3. Factors influencing success in partnerships for sustainability and Local Agenda 2 1 programmes

Source: Selman (1996)

This table shows that widespread participation and reliance on good existing plans and processes are critical success factors. The same holds for combined developmental, economic and environmental initiatives.

It is evident that a policy judgement of successful urban sustainability policies requires the identification and measurement of relevant indicators. An illustrative listing of such indicators can be found in the so-called Dobris Report (see Stanners and Bourdeau 1995) (see also Tables 4 and 5 for a comparative analysis).

In a more analytical way the OECD (1994) has developed the so-called PSR (pressure-state-response) approach (see Figure 4), while the International Institute for the Urban Environment (IIUE 1995) has proposed the so-called ABC (area-basis-core) indicators list (see Figure 5). Such approaches can be very helpful in identifying the driving forces of urban sustainability, while they may also be extremely helpful in pinpointing the relevant criteria to be considered in comparing alternative urban sustainability plans. e.g. by using multicriteria analysis. This approach, which will form the basis of our empirical application, will concisely be described in the next section.

Attributes		Indicators
	A Indicators of urban patterns	
1 Urban population	a) Population	• number of inhabitants in city (1) in conurbation (2)
	b) Population density	• population per km^2 (3)
		• area by density classes (4)
2 Urban land-cover	a) Total area	• area in km^2 (5)
	b) Total built-up area	• area in km^2 (6)
		• by landuse (7)
	c) Open area	• area in km^2 (8)
		• % green areas (9)
		• % water (10)
	d) Transportation network	• motorway length (km) (11)
		• railway length (km) (12)
		• % of total urban area (13)
3 Derelict areas	Total area	• area in km^2 (14)
		• % of total urban area (15)
4 Urban renewal areas	Total area	• area in km^2 (16)
		• % of total urban area (17)
5 Urban mobility	a) Modal split	• number (18) and average length (19) of trips in km per inhabitant per mode of transportation per day
	b) Commuting patterns	• number of commuters into and out of conurbation (20)
		• as % of the urban population (21)
	c) Traffic volumes	• total (22) and inflow/outflow (23) in vehicle-kms
		• (24) number of vehicles on main routes
	B Indicators of urban flows	
6 Water	a) Water consumption	• consumption per inhabitant in litres per day (25)
		• % of groundwater resources in total water supply (26)
	b) Wastewater	• % of dwellings connected to a sewage system (27)
		• number (28) and capacity (29) of treatment plants by type of treatment
7 Energy	a) Energy consumption	• electricity use in GWh per year (30)
		• energy use by fuel type and sector (31)
	b) Energy production plants	• number (32) and type (33) of power and heating plants in the conurbation
8 Materials and products	Transportation of goods	• quantity of goods moved into and out of the city in kg per capita per year (34)
9 Waste	a) Waste production	• amount of solid waste collected in tonnes per inhabitant per year (35)
		• composition of waste (36)
	b) Recycling	• % of waste recycled per fraction (37)
	c) Waste treatment and disposal	• number of incinerators (38) and volume (39) incinerated
		• number of landfills (40) and volume (41) received by waste type
	C Indicators of urban environmental quality	
10 Quality of water	a) Drinking water	• number days per year that the WHO drinking water standards are exceeded (42)
	b) Surface water	• O_2 concentration of urban surface water in mg per litre (43)
		• number of days pH is > 9 or < 6 (44)
11 Quality of air	a) Long term: SO_2+TSP	• annual mean concentrations (45)
	b) Short-term concentration: O_3, SO_2, TSP	• exceedances of AQGs : O_3 (46) SO_2 (47), TSP (48)
12 Acoustic quality	Exposure to noise (inhabitant per time period)	• exposure to noise above 65 dB (49) and above 75 dB (50)
13 Traffic safety	Fatalities and casualties from traffic accidents	• number of people killed (51) and injured (52) in traffic accidents per 10 000 inhabitants
14 Housing quality	Average floor area per person	• m^2 per person (53)
15 Accessibility of green space	Proximity to urban green areas	• percentage of people within 15 minutes' walking distance of urban green areas (54)
16 Quality of urban wildlife	Number of bird species	• number of bird species (55)

*Indicator number in parentheses

Table 4. Selected indicators for the urban environment
Source: Stanners and Bourdeau (1991)

City (country code)	Green areas: accessibility of green space (% of persons 15 min walking)	Green areas (% of city area)	Outdoor noise: population exposure (%) > 65 dB	Outdoor noise: population exposure (%) > 70 dB	Housing space per capita (m^2)	Traffic safety per 10 000 inhabitants: People injured	Traffic safety per 10 000 inhabitants: People killed	Wastewater (% of dwellings connected to sewer)	Air pollution, Long-term: SO_2 + TSP (annual mean)	Air pollution, Short-term: O_3 (max 1 hr)	Air pollution, Short-term: SO_2 (max 24 hrs)	Air pollution, Short-term: TSP (max 24 hrs)
Amsterdam (NL)		●	●	●	●	●	●	●	●	●		●
Barcelona (ES)	●	●		●	●	●	●	●	●			
Belfast (UK)	●				●	●	●	●				
Bergen (NO)	●		●	●	●	●	●	●				
Berlin (DE)						●						
Bilbao (ES)	●	●	●	●	●	●	●	●				
Bordeaux (FR)						●	●					
Bratislava (SK)	●	●		●	●	●	●	●	●		●	●
Brussels (BE)	●	●	●		●	●	●		●	●	m	m
Budapest (HU)		●	●	●	●	●	●	●	●	●	●	●
Chambéry (FR)		●				●	●	●				
Copenhagen (DK)	●			●	●	●	●	●	●	●	●	●
Cracow (PL)		●		●	●	●	●	●	●			
Dnepropetrovsk (UA)	●	●	●	●	●	●		●				
Dubrovnik (HR)	●				●	●	●	●				
Ermoupolis (GR)	●			●		●	●	●				
Evora (PT)	●	●				●	●	●				
Ferrara (IT)	●				●	●	●	●				
Gdańsk (PL)		●			●	●	●	●				
Glasgow (UK)	●					●						
Gothenburg (SE)	●		●	●		●	●	●	●	●	●	●
Hanover (DE)	●	●			●	●	●	●				
Helsinki (FI)		●			●	●	●	●	●	●	●	●
Kiev (UA)	●	●		●	●	●	●	●	●		●	
Liverpool (UK)	●					●		●	●		●	○
Ljubljana (SI)					●	●	●	●	●		●	○
London (UK)												
Madrid (ES)		●			●	●	●	●				
Milan (IT)					●	●	●	●	●		●	●
Moscow (RU)					●	●		●	●			
Odessa (UA)		●		●	●			●	●		●	
Oslo (NO)	●		●	●	●	●	●	●	●	●	m	m
Paris (FR)	●				●	●	●	●	●	●	●	⊖
Prague (CZ)	●	●	●		●	●	●	●	●		●	●
Reggio Emilia (IT)	●			●	●	●	●	●				
Rennes (FR)		●				●	●	●				
Reykjavik (IS)	●				●	●		●	●		●	●
Riga (LV)					●	●	●	●	●			
Rotterdam (NL)		●			●	●	●	●	●	●	●	●
Sheffield (UK)												
Sofia (BG)	●			●	●	●	●	●	●		●	
Stockholm (SE)	●		●	●	●			●	●	●	●	
St Petersburg (RU)				●				●	●	●	●	
Tirana (AL)	●				●	●	●	●	●		●	●
Toruń (PL)		●			●	●	●	●				
Valletta (MT)	●			●		●	●	●				
Venice (IT)	●			●		●	●	●				
Vienna (AT)					●	●	●		●		●	
Warsaw (PL)	●				●	●	●	●	●	●	●	
Zagreb (HR)	●	●			●	●	●	●	●		●	●
Zurich (CH)	●	●		●	●	●	●	●	●	●	●	●

Green areas (% of population): ● >50; ● ≤50

Green areas (% of city): ● >30; ● 5–30; ● <5

Outdoor noise (%): > 65 dB: ● <25; ● 25–50; ● >50. > 70 dB: ● <5; ● 5–10; ● >10

Housing space per capita (m^2): ● >40; ● 20–40; ● <20

Traffic safety: people injured: ● <25; ● 25–50; ● >50. people killed: ● <1; ● 1–3; ● >3

Wastewater (%): ● 100; ● 90–99; ● <90

Long-term air pollution
Annual mean concentrations of air pollutants at city background stations ($\mu g/m^3$)
SO_2 + TSP
● <100
● 100–200
● >200

Short-term air pollution
Exceedances of AQGs ($\mu g/m^3$)
AQGs for: O_3 = 150 (max 1 hr), SO_2 = 125 (max 24 hrs), TSP = 120 (max 24 hrs)
O_3, SO_2, TSP
● <1 AQG
● 1–3 AQG
● >3 AQG

Table 5. Urban environmental quality
Source: Stanners and Bourdeau (1991)

Issues	Pressure	sure	Response
I. Source Indicators			
1. Agriculture	Value Added/Gross Output	Cropland as % of wealth	Rural/Urban Terms of Trade
a. Land Quality	Human-induced Soil Degrad.	Climatic Classes & Soil constraints	
b. Other			
2. Forest	Land Use Changes, Inputs for EDP	Area, volumes, distribution, value of forest	In/Output ratio, main users, recyc. rates
3. Marine Resources	Contaminants, Demand for Fish as Food	Stock of Marine Species	% Coverage of Int'l Protocols/Conv
4. Water	Intensity of Use	Accessibility to Pop. (weighted % of total)	Water efficiency measures
5. Subsoil Assets	Extraction Rate(s)	Subsoil assets % wealth	Material balances/NNP
a. Fossil Fuels	Extraction Rate(s)	Proven Reserves	Reverse Energy Subsidies
b. Metals & Minerals	Extraction Rate(s)	Proven Reserves	In/Output ratio, main users; recyc. rates
II. Sink or Pollution Indicators			
1. Climate Change			
a. Greenhouse Gases	Emissions of co'	Atmosph. Concern. oi Greenhouse Gases	Energy Efficiency of NNP
b. Stratospheric Ozone	Apparent Consumption of C ' G	Atmosph. Concentr. of CFCs	% Coverage of Int'l Protocols/Conv.
2. Acidification	Emissions of SO_x, NO_x	Concentr. of pi-?. sox. NO* in precipitation	Expenditures on Pollution Abatement
3. Eutrophication	Use of Phosphates(P), Nitrates(N)	Biological Oxygen Demand, P, N in rivers	% Pop. w/waste treatment
4. Toxification	Generation of hazardous waste/load	Concentr. of lead, cadmium, etc. in rivers	% Petrol unleaded
III. Life Support Indicators			
1. Biodiversity	Land Use Changes	Habitat/NR	Protected Areas as % Threatened
2. Oceans	Threatened, Extinct species % total		
3. Special Lands(e.g.,wetland)			
V. Human Impact Indicators			
1. Health	Burden of Disease (DALYs/persons)	Life Expectancy at birth	% NNP spent on Health, vaccination
a. Water Quality		Dissolved Oxygen, faecal coliform	Access to safe water
b. Air Quality	Energy Demand	Concentr. of particulates, SO_2, etc.	
c. Occupat'l Exposures,etc.			
2. Food Security & Quality			
3. Housing/Urban	Population Density (persons/km^2)		% NNP spent on Housing
4. Waste	Generation of industrial, municipal waste	Accumulation to date	Exp. on collect. & treatmt., recyc. rates
5. Natural Disaster			

Figure 4. The PSR approach
Source: OECD (1994) and **WRI** (1995)

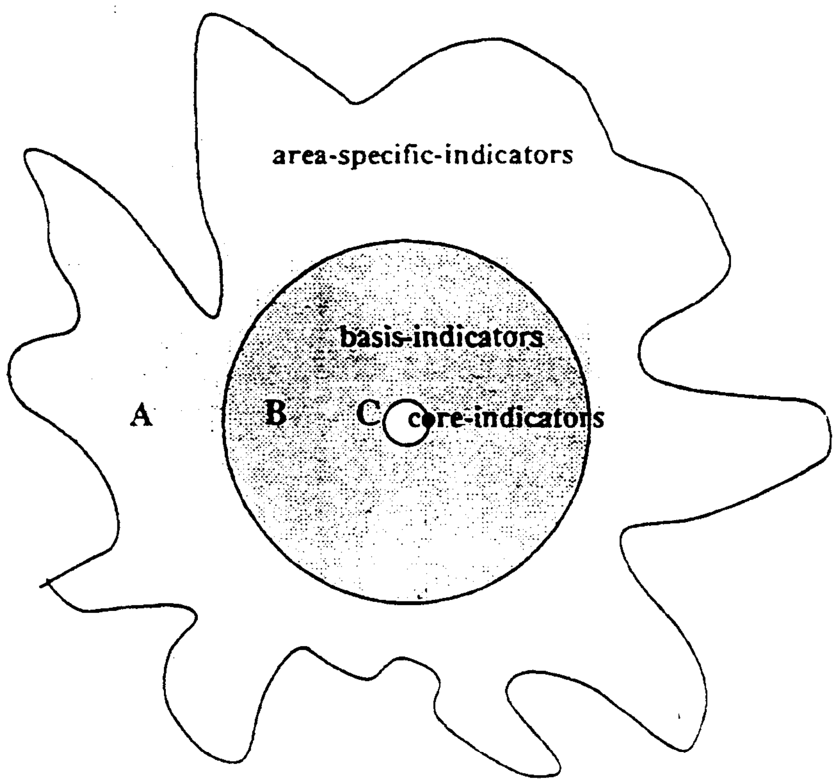

Figure 5. The ABC approach
Source: IIUE **(1995)**

5. The Need for Proper Evaluation Methods

The previous sections have pointed out that urban sustainability - as a policy concept - is not an unambiguous state of affairs, but a multi-faceted phenomenon fraught with conflicts and uncertainties. The notion of a sustainability city comprises a great variety of dimensions, such as economic, social, land use, ecological and transportation interests among which a balanced compromise has to be found by urban policy-makers. Conflict resolution is of course a political action, but presupposes proper knowledge on the pros and cons of alternative choice possibilities. From an economic perspective, this would imply that all foreseeable costs and benefits of a planned initiative would have to be assessed. Policy analysis offers an assessment and evaluation framework in the public sector with the goal to increase the efficiency and effectiveness of government decisions. In this sector in particular, a wide range of decisions is to be made without a clear reliance on the market system. This is partly caused by the nature of choices in the public sector (with emphasis on multi-actor democratic modes of decision-making) and partly by the complexity of government projects (with long-lasting and often uncertain implications). And it is indeed increasingly recognized that decisions based on market forces alone do not necessarily lead to optimal results. Structural market failures as well as unexpected external factors may require an efficient policy mechanism that is able to lay the foundation for an improvement of the actual socio-economic developments within a community or soiecty. Clearly, the initiation of structural policies or-the implementation of corrective measures is often not the responsibility of a single government agency, but rather may take place on several organizational levels ranging from local to supranational.

In the past decades several methods have been developed and applied in policy analysis. in which a market evaluation played a prominent role. The most well-known example of such a market evaluation method is based on *cost-benefit analysis* (as an operational application of welfare theory). This method forms the foundation for many policy assessment methods and has been successfully applied in many case studies. Despite its great many merits, it is increasingly recognized in modern policy analysis that is also has some limitations, because not all relevant welfare implications of transport initiatives can be expressed in the ' measurement rod of money'.

We may conclude that cost-benefit studies seem to be most applicable and appropriate if the decision concerns a well-demarcated and a priori precisely defined project which does not generate many unpriced externalities. If however, the decision concerns a more general policy programme (of which the details and even sometimes the major features are unknown), then the translation of this impacts into precisely measurable and qualitative consequences and subsequently into monetary figures is often rather problematic. Similarly, if a public investment is likely to generate a wide diversity of social costs (e.g.. landscape destruction, loss of safety, health effects, loss of biodiversity or rare species. destruction of archaeological sites), it is often a heroic research task to come up with reliable figures which are broadly accepted in the policy area. This does not mean that cost-benefit analysis would have to be discredited; but it would have to be complemented with more appropriate evaluation tools.

A great diversity of modem assessment methods has been developed over the last ten years to extend the range of and to provide a complement to conventional cost-benefit analysis and to offer a perspective for procedural types of decision-making in which various quality aspects are also incorporated. Many of these methods simultaneously investigate the impacts of policy strategies on a multitude of relevant criteria, partly monetary, partly non-monetary (including qualitative facets). They are often coined *multicriteria methods* and are also known as multi-assessment methods.

It is noteworthy that in past years an avalanche of assessment studies has been undertaken in the regional, transportation and environmental field, but an integral study and a systematic comparison of findings of previously undertaken assessment studies is often difficult due to different analytical approaches and differences in presentation. The gradual shit? from conventional assessment techniques (such as cost-benefit analysis) towards multi-dimensional assessment approaches (such as multicriteria analysis) has prompted the need for a systematic comparison of these studies, but this requires an enormous study effort and induces, as a consequence, a significant research cost.

In order to reach a satisfactory policy in a complex environment, a careful process of decision-making is required which takes time and can be costly. The problems underlying a decision-making process in a spatial context may be subdivided into the following components:

- the information or data available always contain a component of uncertainty;
- the data or information may be stored in different data bases that may be difficult to access, manipulate, compare and study:
- a large set of - often conflicting - objectives or targets has to be taken into account;
- the decision-making process itself might be influenced by power relations or selfish motivations;
- a decision-making process has to take place within the shortest time possible to avoid countervailing effects.

This means that in any societal setting the best alternative or policy has to be determined which may boost public acceptability or at least social feasibility; in other words, the basic question is: what is the optimal policy? Theoretically, a decision-maker has to deal with an optimisation procedure, where from a set of alternatives the possible optimal choice is to be found, given the objectives and underlying conditions and constraints in real life.

Most decisions can be typified as being of a multiple objective or multicriteria type (Janssen 1991, Nijkamp et al. 1991, Beinat and Nijkamp 1998). This means that an optimal alternative from a set of alternatives is to be determined which best satisfies a number of - often conflicting - objectives. Another complicating factor is that on the policy level - besides a set of quantitative criteria - qualitative criteria also must be taken into account in a decision-making process. Examples are the interest of the biotic and a-biotic environment, the protection of school children, accessibility conditions of the elderly generation, or the risk of criminality in public transport. In the past, the research has often resorted to cost-benefit analysis as on the appraisal method, and this has often been done in a successful way. However, as mentioned above, this method has severe shortcomings when it comes to an operationalisation of intangible facets, so that there are many justified reasons for the sometimes limited applicability of this method. In public policy evaluation, especially the study of environmental impacts turned out to be troublesome, since all advantages and disadvantages of policy options have to be translated into a common monetary unit. Hence, qualitative criteria of an unpriced and intangible nature cannot be included in the decision-making procedure based on a standard cost-benefit analysis. Within this approach, the market priorities are reflected in the (corrected) market prices or through the willingness-to-pay of the individuals (see Janssen 1991). In the practice of cost-benefit analysis, it was difficult to include incommensurable aspects of a project. Similarly, in the current practice in many countries there was hardly any applicable and meaningful way of including distributional impacts on welfare (e.g.. through a weighting system for different groups) into policy evaluation, even though there is in the history of cost-benefit analysis theory in economic research a vast amount of literature of distributional issues (e.g. through weighting systems, social rates of discount, etc). Clearly, a complementary decision-making process better able to handle qualitative information in a more sophisticated way seems to be very useful with respect to decision-making. Consequently, for our analysis of urban sustainability initiatives we will resort to multi-criteria analysis. In our case study on Cremona this will be further illustrated.

After this exposition on the use of modem evaluation methods, we will now move to an empirical application on urban sustainable policy in which a choice among rivalry option has to be made. The case study concerned is the Italian city of Cremona and will be further described in the next section.

6. A Case Study on Cremona (Lombardia, Italy)

This section aims to provide useful elements for a sustainable town planning scheme, which is a fundamental tool typical for territorial planning in many countries. The case study will focus on a balanced development for the city of Cremona (Lombardia, Italy).

The system complexity requires qualitative methodological approaches such as the above mentioned multicriteria analysis. This analysis, of course, cannot be considered to exhaustively describe all the possible development scenarios of the city; it is nevertheless useful to the planner for an optimal allocation of scarce resources.

Cremona is a small to medium sized town (about 72,000 inhabitants) in the Lombardia Region (Not-them-Italy) sited at the Po plain. Its economy is traditionally dominated by agricultural (especially dairy-farming) and agro-food sectors that have been gaining high productivity levels and a crucial role in the Po area. Furthermore, the town is characterised by a delayed but strong industrialisation process, that took place in the 60's and 70's. The Local Plan (PRG, the Piano Regulatore Generale), which is being developed together with the Provincial Territorial Plan, creates an important occasion to build a lively and attractive town. However, the Town Council still has to face the choice among different plan development options, which are all important but are also bound by the town budget restrictions.

In order to identify the Local Plan project choices and the objectives to be maximised, it is necessary to start from a preliminary study of the territory and of the urban economic and social dynamics. This first phase has proven to be essential to test the feasibility of some projects, and to select the most significant objectives/indicators. The analysis has been subdivided into:

- social and demographic analysis;
- economic analysis (agricultural, industrial and service sectors).

The research has brought to light some remarkable information, The elderly share in 1996 turns out to be relatively high: 207%. This means that the share of the elderly is more than twice that of the young people. The economic system is dominated by commercial and bank activities (5 1% of GDP), whereas industry and tourism are less important,

Though rich from an economic and cultural point of view, Cremona is feeble in terms of an endogenous growth of its economic system. This town needs a new stimulus for its production system, and more dynamism in general, a lack which is probably due to the high portion of elderly people. A dynamic and competitive urban system has to face various crucial issues regarding the maintenance of its market position, including in particular:

- a sufficient carrying capacity (soil, natural and manufactured resources);
- a rich supply of multidimensional public services (e.g., a local system of training/information);
- a supply of sophisticated communication and interaction networks.

The main priorities brought to light by our policy analysis relate to the need for a sustainable development (i.e. a development process that safeguards and regenerates environmental and architectural resources, and pays due attention not only to suburbs, but also to the entire urban territory). Such priorities can be summarised as follows:

- protection of green areas;
- design of a mobility plan;

- recovery of the existing urban area (derelict areas);
- strengthening and exploitation of the commercial system;
- cultural and tourist promotion.

Urban environmental quality depends both on natural and on social elements. The essential factors of urban life are a low pollution of the air-water-soil system, good conditions of buildings, and green areas. Further aspects to be considered are the presence of a development potential for alternative economic activities, recreation and social interaction. All these factors are clearly interdependent within an urban system.

7 Multi-criteria Analysis for the Local Plan of Cremona

7 1 Introduction

Muiticriteria analysis (MCA) is a guiding tool to the choice among n finite and *ex ante* expressed alternatives (projects), which are evaluated in relation to a finite number of criteria, for which each distinct alternative presents a performance index or score. "*In particular MCA has various major advantages on the sustainable land* **use** *which is a multi-faced concept and it comprises many dimensions of economic activity in relation to land use and environmental quality*" (Finco and Nij kamp, 1999).

One of the main issues regarding MCA is its model flexibility and its user-friendliness. as it has to be easily implementable by everybody involved in policy-making and should in particular support the policy-making process. In our case study the MCA is a support system for policy makers to choose different projects to implement a new Local Plan (PRG) of the City. The multicriteria evaluation problem related to the Cremona alternatives is characterised by qualitative information (e.g. ordinal or binary).

The study phases for Cremona are the following:

1. choice of the alternatives;
2. choice of the indicators;
3. weight assignment to criteria (on the basis of 3 policy simulations);
4. matrix construction and score assignment;
5. software implementation;
6. evaluation of policy options

The selection of n finite alternatives and of k indicators represents the impact assessment matrix, while the indicators /criteria are policy objectives to be Pareto-maximised (see Table 6).

Table 6. Multicriteria analysis · impact matrix of the Cremona project

	ALTERNATIVES / CRITERIA	1 Rural Restructuring (agritourism etc.)	2 Park project	3 Systems d waste recycling (e.g. incinerators).	4 Street furniture/ restructuring built	5 Suburban Commercial System	6 Parking system	7 n o w system	8 Public transportation network	9 Buildings eldery People (Derelict Area)	10 Cultural Centre Conservatoire/ Auditorium (Derelict Area)	11 University Centre (Derelict Area)	12 Meeting Centre (Derelict Area)
1	Variation in GDP	6	6	7	8	10	6	8	7	9	10	9	9
2	Variation in empl Variation in employment	6	6	7	8	8	5	8	7	9	7	9	7
3	Integration of production sectors	7	9	6	7	8	7	9	9	6	6	8	9
4	Job mobility	7	7	7	7	8	6	7	7	8	8	7	7
5	Developmen I SME	6	9	6	6	9	9	9	9	6	6	7	9
6	Commuting patterns	5	6	6	7	8	10	10	10	IO	6	9	6
7	Administrative efficiency	6	IO	9	6	7	9	9	9	9	9	9	9
8	accessibility to education	6	2	6	2	2	10	9	IO	6	9	10	10
9	Accessibility to sports facilities	7	1	IO	5	1	8	8	a	7	1	7	2
10	Accessibilityto welfare provisions	6	7	IO	4 7	10		8	10	10	10	9	10
11	Accessibility health service	1	10	2	2	1	7	9	7	10	4	4	4
12 / 13	Accessibility ... service / Availability bank services	8 6 / 7	6	7	5 / 5	5	9	8 7	8	6		10	IO
14	Public security	6		9	6	8	a	8	5	7	8	8	9
				5	2	4	a	7	8	7	5	3	5
15	Housing quality	6	7	10	10	1	7	7	7	2	7	5	5
16 / 17	Population density	8	1	a 10	9	9	10	9	10	6	a	a	9
					6	6	3	7	2	3	2	6	5
16	Ageing	2		7 9	6	9	10 9		10	6	7	9	7
19	Information systems	1	7	8	4	9	9	9	10	10	6	6	3
20	Cultural public relations	6	6	9	1	2	6	2	5	10	9	8	8
21 / 22	Social integration / Transport and traffic	7 / 6	2 / 1	6	a	4	7	6	6	7	10	10	10
	quality			5	4	a	6	3	a	5	9	9	9
23 / 24	Facilities for handicapped children / Civil participation	6	7	8	6	7	10	10	10	8	a	10	10
		7		1	7	6		10	10 10	10	8	9	8
25	% of waste recycled	5	5	7	4	a	5	4	5	6	10	6	6
26	Quality of urban nature area	10	7 10	7	6	5		1	5	1	1	4	4
27	Energy consumption	7	7	6	5	7	5	7	7	5	4	5	7
28 / 29	Urban green per person / Landscape areas	10 / 7	IO	10	9	9	IO	7	7	7	1	1	2
			8	10	7	7	4	6	4	6	6	6	6
30 / 31	Air pollution / water pollution	7 / 4	3	10	5	5	1	2	1	5	5	5	5
			3	10	5	5	5	5	5	3	5	5	5
32	Soil pollution	4	4	10	5	4	4	3	3	5	5	5	5
33	Noise												
34		7	10	5	4	1		1	2	6	4	5	5
35	Renewal rural areas / % derelict areas	10	8	10	6	2	5	3	6	6	6	5	5
				7	5	5	5	5	5	8	8	9	8

Legend Ordinal numbers are to be interpreted as: 'the higher the better'

The selection of the project alternatives has involved the main social actors and policy-makers (economic actors, such as unions, enterpreneurs, professional associations; social groups, etc.) according to a bottom up strategy for achieving urban and territorial sustainability. A questionnaire was prepared in order to collect the choices that each relevant group thinks to be indispensable. Such projects were then tested and compared with the policy-makers opinion.

In the original methodological approach there were 35 alternatives for future development of the city. They have been reduced in our case representation to 12 choice possibilities. This choice is typical of a strategic planning approach. The method of MCA allows also to make a cluster for land use policy. In the assessment matrix it is possible to have the most important alternatives envisaged. The selected project alternatives are all efficient from the point of view of an urban financial aspect. The project alternatives considered regard not only economic issues, but also environmental and social interventions that are indispensable for a sustainable town planning.

The selected criteria/indicators (35) comprise the economic, social and environmental aspects of the urban territory considered. The importance of the choice of indicators has already been discussed in the previous sections. The classification has been made by referring to the stratification of the three different constituents of urban and territorial sustainability, on the ground of standard international classifications (HUE, Dobris Report. etc.) As the table clearly shows, social and environmental indicators play a particular role according to international urban sustainability principles.

There are however, traditional economic indicators such as GDP, which corresponds to the overall value of goods and services produced within a certain territory, and employment rate, which can be considered to be a socially important economic parameter. Among the environmental criteria in the check list appear the proportion of waste recycled and recovery of agricultural land sited in suburban areas; the former is used as a proxy of the carrying capacity of an urban system which is strongly dispersing, while the second refers to the above described notion of ecological footprint (Rees, 1992, Segale, 1993).

Weight assignment to criteria is fundamental in MCA, as the weighting vector represents the relative importance of each criterion. As a starting point, the various weights are often assumed to be equal. But in the overall study approach, three different weight tests have been applied (see Table 7):

Table 7. Criteria and weight system of the Cremona case study

		CRITERIA	A*	B*	C*
1	ECONOMIC	Variation in GDP	10	1	7
2		Employment rate	10	1	10
3		Integration of product sectors	8	1	4
4		Job mobility	9	1	2
5		Development SME	8	1	8
6	SOCIAL	Commuting patterns	9	1	2
7		Administrative efficiency	8	1	4
8		Accessibility to education	8	1	7
9		Accessibility to sports facilities	8	1	5
10		Accessibility to welfare work	7	1	6
11		Accessibility to health services	8	1	8
12		Accessibility post services	8	1	3
13		Availability bank services	7	1	3
14		Public security	8	1	8
15		Housing quality	8	1	5
16		Quality of life	7	1	10
17		Population density	8	1	1
18		Ageing	9	1	5
19		Information systems	9	1	1
20		Cultural public relations	7	1	3
21		Racial Integration	8	1	7
22		Transport and traffic quality	7	1	8
23		Facilities for handicapped children	9	1	10
24		Civil participation	8	1	4
25	ENVIRONMENT	% of waste recycled	7	1	5
26		Quality of urban nature area	5	1	4
27		Energy consumption	7	1	5
28		Urban green areas per person	7	1	10
29		Landscape	7	1	4
30		Air pollution	9	1	10
31		Water pollution	9	1	10
32		Soil pollution	9	1	10
33		Noise	9	1	4
34		Renewal rural areas	5	1	4
35		% derelict areas	7	1	2

Legend: Ordinal numbers are to be interpreted as: "the higher the better"

* A = original weights by policy makers
B = all weights equal
C = weights of experts on a 1-10 scale

(1) weights specified by the Cremona Town Council representatives, according to a 5-10 scale (weight set A)

(2) equal weights for all criteria (weight set B)

(3) weights defined by the experts according to a lo-point scale' (weight set C).

In all these cases the highest weight score is defined as the best (the higher the better). Some prior interesting remarks on the Town Council weights can be made.

A high importance (weight = 10) was attached to the economic criteria (GDP rise and employment increase). This fact proves how much the Cremona area needs an immediate economic strengthening. But also environmental criteria receive a remarkably high weight confirming an increasing interest in environmental safeguarding and in future sustainable development. In the same way, information and communication channels, network services as well as social services related to handicapped children and elderly people are regarded as important. The quality of urban nature life and land recovery in the urban suburbs are apparently considered a less important problem.

Concerning the weight vector construction by experts on a lo-point scale, the highest weight has been given to social and economic issues, such as employment and environmental criteria (including green areas and availability of parks), which seem to be considered as a necessity by the community.

This next phase concerns a score assignment, representing the performance index of each alternative in relation to each criterion. In this case too, a lo-point scale, with 1 as the worst and 10 as the best performance, has been used.

Two alternative MCA evaluation methods are used, viz. the well-known weighted summation technique and the concordance method. In the latter case, a software programme based on concordance analysis, named the VISPA programme, was used for the various successive operations, the first being the construction of the data matrix. Though the VISPA program is not recent and available only on MS-DOS, it has all the necessary characteristics and allows even for a certain interactivity with the user.

The main logic phases of the programme are the following:

- Normalisation of indicators, i.e. standardisation of each measurement unit of the indicators;
- Utility function assignment, for the transformation of indicators into objectives to be maximised;
- Weight assignment;
- Performance of sensitivity test;

[1] A lo-point scale also has been used for alternative scores during the matrix construction phase.

- Concordance and discordance analysis and their respective indexes;
- Final ranking of alternatives.

The programme shows in particular different kinds of ranking, among which the most important one is the weighted sum derived from the previous phase of weight assignment. Other ranking criteria are those based on the concordance index, on the discordance index, on the worst case, etc. For each k-th alternative, the concordance index ranking is obtained by calculating for the concordance matrix' the difference between the k-th row sum and the k-th column sum. The best alternatives are of course those with high positive values.

Our analysis will thus consider two ranking methods: the weighed summation method and the concordance method. Their results will be compared for three different weight assignment options (weight sets A, B and C).

7.2 Results

The results of the rankings from the two alternative evaluation methods are shown in Tables 8 and 9. The weighted summation ranking (Table 8) does not present essential differences among the A, B and C options, at least for the first positions. The first selected alternative is the Park Project implementation (alternative 2) for each of the weights assigned to the objectives The University Centre and the Meeting Centre (alternatives 11 and 12) are respectively in the second and the third position. The other positions are assumed by public transport. road system and parking strengthening projects (alternatives 8, 7 and 6) with some slight differences among the A, B and C options of the weight sets. Considering in particular the policy-makers' weights, public transport turns out to be more urgent than the other two alternatives, given the present inadequacy in both the urban and the extra-urban context. These interventions are clearly important not only for the community, but they are also an essential condition for a greater efficiency and dynamism of productive and commercial sectors. The project alternative concerning social services development through building of retirement homes, is likely to be a good choice as well, as it regards an alternative use of abandoned areas.

Generally speaking, such areas are abundantly available and occupy a wide surface of the urban territory (university area, meeting centre, social services) and their recovery can produce various significant advantages in the urban social, environmental and productive context.

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[2] The concordance matrix is a matrix for a comparison of alternatives. It is an n x n squared matrix. where n is the number of alternatives in which for each dominance relationship in a pair-wise comparison the corresponding weights are added up.

We will now turn to the results from the concordance analysis. It turns out that in the concordance index ranking (Table 9) the position of the first four choices is the same as in the previous ranking (weighted summation), with very slight variations in relation to the different weight assignments to the criteria concerned.

It is also necessary to carry out an exploratory test on the robustness of the model results. Therefore, a sensitivity analysis is undertaken in which the weight variation is fixed in intervals within which the alternative is constant. This can be obtained with an artificial variation (both an increase and a decrease) of a weight, while maintaining the others constant. The weight investigated has no sensitivity when the resulting ranking does not change whatever the weight value is. But it has a very high sensitivity, when even a small variation causes alterations in the ranking of the alternatives; clearly, if a weight has low or no sensitivity, the respective objective cannot influence the alternative ranking whatever its importance is. Table 11 shows the results of the sensitivity test. The gradient (+, 0, -) represents a strong, zero or weak sensitivity of some criteria. Clearly, the sensitivity test has only been done for weight sets A and C.

The test points clearly out the necessity to consider every time when an MCA analysis is used each criterion weight with utmost caution. In the case of weight set A in particular, all environmental criteria have turned out to have a high sensitivity. Even slight appraisal differences produce strong alterations in the alternative ranking and consequently in the final choice.

Finally, we may also investigate the degree of domaince of alternatives. We find for the concordance index analysis by seeking for the total importance of the objectives for which an alternative dominates the others, that the University Centre is the greatest success alternative, showing a score of 1,9 (Table 10).

The above study results suggest also projects concerning territorial marketing and the service sector. The model constructed embodies also some strategic choices for urban development, that can be further considered in a subsequent phase. As said previously, it is possible to repeat the method also for one or more selected projects, or for a more specific in-depth analysis. It will be also possible to change the critical threshold values for each indicator. The analysis has pointed out that the most preferable projects belong preponderantly to the service sector and follow the development trends of most Italian and EU economies.

8. Conclusions

It goes without saying that sustainable development is a general issue that may be applied to all levels of strategic spatial planning. It refers to the natural environment as

Table 8. Results according to weighted summation for three weight sets (A, B and C) ranked from 1 (the best) to 12 (the poorest)

									Derelict Area			
ALTERNATIVES	1 Rural restructuring (agritourism etc.)	2 Park project	3 Systems of waste recycling (Incinerator).	4 Street furniture/ restructuring built	5 Suburban Commercial System	6 Parking system	7 Road system	6 Public transportation network	9 Buildings elderyk	10 Cultural Centre Conservatoire/ Auditorium	11 University Centre	12 Meeting Centre
weight A	11	1	10	12	9	7	5	4	6	8	2	3
weight B	11	1	10	12	9	6	5	4	7	8	2	3
weight C	11	1	10	12	9	8	4	5	6	7	2	3

Table 9. Results according to concordance analysis for three weight sets (A, B and C) ranked from I (the best) to I? (the poorest)

									Derelict Area			
ALTERNATIVES	1 Rural restructuring (agritourism etc.)	2 Park project	3 Systems of waste recycling (Incinerator).	4 Street furniture/ restructuring built	5 Suburban Commercial System	6 Parking system	7 Road system	6 Public transportation network	9 Buildings eldery People	10 Cultural Centre Conservatoire/ Auditorium	11 University Centre	12 Meeting Centre
weight A	11	2	10	12	9	7	6	8	5	8	1	3
weight B	11	1	10	12	9	6	7	4	5	8	2	3
weight C	11	1	10	12	9	8	7	5	4	6	2	3

Table 10. Concordance index results

									Derelict Area			
ALTERNATIVES	1 Rural restructuring (agritourism etc.)	2 Park project	3 Systems of waste recycling (Incinerator).	4 Street furniture/ restructuring built	5 Suburban Commercial System	6 Parking system	7 Road system	8 Public transportation network	9 Buildings eldery People	10 Cultural Centre Conservatoire/ Auditorium	11 University Centre	12 Meeting Centre
weight A	-	1.6	-	-	-	0.3	0.7	0.9	0.8	-	1.9	1.4
weight B	-	1.8	-	-	-	0.4	0.3	0.8	0.5	-	1.6	1.4
weight C	-	2.4	-	-	-	-	0.9	0.1	0.5	0.9	2.1	1.7

Table 11. Sensitivity test of criteria

		CRITERIA	Weight set A	Weight set C
1	ECONOMIC	Variation in GDP	+	+
2		Variation in employment	+	+
3		Integration of production sectors	+	+
4		Job mobility		
5		Development SME	+	+
6	SOCIAL	Commuting patterns	+	+
7		Administrative efficiency		
8		Accessibility to education	+	
9		Accessibility to sports facilities	+	0
10		Accessibility to welfare provisions	0	0
11		Accessibility health service	+	+
12		Accessibility post service	+	+
13		Availability bank services	+	+
14		Public security	+	
15		Housing quality	+	0
16		Quality of life		-
17		Population density		-
18		Ageing	+	
19		Information systems		
20		Cultural public relations		
21		Racial integration	+	+
22		Transport and traffic quality	+	+
23		Facilities for handicapped children	+	+
24		Civil participation	+	
25	ENVIRONMENTAL	% of waste recycled	+	
26		Quality of urban nature area	+	0
27		Energy consumption	+	
28		Urban green areas per person	+	0
29		Landscape	+	0
30		Air pollution	+	0
31		Water pollution	+	0
32		Soil pollution	+	0
33		Noise	+	0
34		Renewal rural areas	+	0
35		% derelict areas	+	+

Legend: + = high sensitivity 0=no sensitivity - = low sensitivity well as to the urban and rural system. It offers the opportunity to evaluate adequately public goods by acknowledging their complex nature and eventually showing the relevance of non-market processes. A final reflective question is now: how can we be sure that the development and planning of a territory follows the general guidelines of sustainability'?

There are three basic conditions to be fulfilled. Firstly, the use of time series and cross-section indicators, that can help to identify possible development distortions and the related necessary corrections. Secondly, the assignment of responsibility to all stakeholders involved, who have the position to exercise priority interventions for each site, or to intervene in possible "emergencies" (economic, social or environmental). Thirdly, the adoption of policies for territorial safeguarding, that minimise environmental impacts and start a general recovery process. Such a scenario becomes feasible when an integrated development model is adopted, which can emphasise the territorial propensities and the social requirements involved. Strategic planning is the solution for this kind of problem: its application becomes essential also at an urban level, and exploits the relationships between urban and agro-environmental systems.

Is it possible to map out a successful path for the above sketched concertation process? In this context the policy-maker has a crucial role, as he is the link between the local system and the macro system (e.g the European urban system). He must therefore gain new capacities and skills and ensure more interactivity in order to be responsible for political and territorial choices. What seems clear is that policy-makers have little knowledge about the general European and international policy guidelines. which might also offer financial support at a EU level. We refer specifically to the *Local Agenda 21* and the *Aalborg Charter* programmes.

A further consideration concerns the general difficulties in the use of appraisal methods for the support of policv-making. These methods are easily managed with specific software packages, that are usually flexible and user-friendly.

The choice of multicriteria analysis derives from the above mentioned motivations. namely the necessity to provide new decision models to policy-makers, that can take into account the multidimensional nature of the development process. Given that the planning process is becoming a sort of art of communication, trying to reduce conflicts among the various social parties, this kind of model is characterized by:

- the possibility of optimising the choice among different alternative projects. promoting a territorial sustainable development;
- the possibility of managing the plan through the necessary negotiations among social parties or stakeholders.

Social parties might modify the way of managing public goods, as they can play an active role in the promotion of investments for the creation of the basic conditions of social and economic development in the city.

Many are the policies where public and private sectors can and should collaborate for the promotion of the sustainable development of the city. It is therefore also necessary to approach the issue of territorial and urban sustainability from a meso-economic perspective. and to suggest a new management, that considers environmental quality at the same level as traditional production factors, i.e. an input in the production process. The application of the multicriteria approach in the present paper has tried to pursue this demand. providing a methodology for ranking different alternative projects. The basic concept is that of optimising a set of indicators/criteria/objectives that are considered to be critical factors for the idea of sustainable development and of urban welfare.

The main positive aspect of this approach is the rationalisation and transparency of the urban decision process. obtained through the active participation of the individuals involved. both in the indicator-setting phase and in the project-choice phase.

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